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Division of Mycology and Disease Survey
BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING
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The Plant Disease Reporter is issued as a service to plant pathologists throughout the United States. It contains reports, summaries, observations, and comments submitted voluntarily by qualified observers. These reports often are in the form of suggestions, queries, and opinions, frequently purely tentative, offered for consideration or discussion rather than as matters of established fact. In accepting and publishing this material the Division of Mycology and Disease Survey serves merely as an informational clearing house. It does not assume responsibility for the subject matter.

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THE PLANT DISEASE SURVEY
DIVISION OF MYCOLOGY AND DISEASE SURVEY

Plant Industry Station — Beltsville, Maryland
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MOTTLE NECROSIS OF SWEET POTATOES IN LOUISIANA

W. J. Martin

The occurrence of mottle necrosis of sweet potatoes in Louisiana was recorded for the first time on July 29, 1949. The disease was observed in severe form in several fields of Porto Rican sweet potatoes in the Leonville area of St. Landry Parish. The severely-affected fields were located in the heavier soil types of that area. These soils were extremely wet during July and August when the rainfall was considerably above normal. The rot was characteristic of that described by Harter and Weimer (2) as mottle necrosis.

The fungus isolated from the diseased potatoes appears to be different from both Pythium ultimum Trow and P. scleroteichum Drechs., the two principal species to which mottle necrosis has been attributed (2). It is a fast-growing Phycomycete which is readily observed in the affected host tissue. So far, fruiting structures have not been observed. Neither conidia nor oogonia were observed when the fungus was cultured on corn-meal agar and on acidified corn-meal agar, media described by Drechsler (1) as suitable for observing oospores in P. ultimum and P. scleroteichum.

Inoculation of sweet potatoes with the fungus resulted in typical mottle necrosis when puncture-inoculated potatoes were kept in moist cotton. The severity and rate of development of the disease were similar at 22° C. and 32° C. Approximately one-half of the inoculated sweet potatoes failed to develop mottle necrosis, and developed only small circular spots at the point of inoculation. Yet certain naturally-infested fields showed up to 75 percent of the sweet potatoes affected when the crop was plowed up.

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LOUISIANA AGRICULTURAL EXPERIMENT STATION, BATON ROUGE, LOUISIANA

SEVERAL SPECIES OF PARASITIC NEMATODES ON PEANUTS IN GEORGIA

Lytton W. Boyle

During August, 1949, our attention was called to a field of Spanish peanuts marked with patches of badly stunted, chlorotic plants. Analysis of soil samples from respective areas of the field showed a relatively low, but uniform level of fertility and no clue as to the cause of the patches of poor growth. More critical examination of the field showed the poor patches were rather sharply limited. No gradient in growth or size of the plants was evident between the poorer and better areas of the field. Instead, in the periphery for several feet around the poorer area, relatively well developed plants were thoroughly randomized with badly dwarfed stunted plants. Comparative examination of the roots of such plants showed the badly stunted chlorotic specimens were more thoroughly infested with nematodes.

Specimens from this field near Dawson, Georgia, were submitted to Dr. G. Steiner, Division of Nematology, U. S. Bureau of Plant Industry, Soils, and Agricultural Engineering, for critical determination of the species of nematode. His report, in part, was as follows: "- - - the peanut roots were infected by at least two species of meadow nematodes. In addition Tylenchorhynchus claytoni was present, and also a species of Criconemoides. All three are outstanding root parasitic nematodes - - -."

Later at harvest near Albany, Georgia, small dark-colored pock marks were noted on the shells of Spanish peanuts. These were often numerous and large enough to give the fruit a very unattractive appearance. Examination of these pocks showed them to be filled with nematodes. The infestation first appeared as small pustules over the shell. As these were broken, the dark-colored pocks were exposed. At least 95 percent of the nuts showed such markings to a greater or lesser degree. No evidence was found that the nematodes penetrated further than the shell of the nut. Unlike the field described above, this field had been relatively well fertilized and the growth appeared uniform as well as vigorous. The infestation was not apparent until the

crop was lifted.

Dr. Steiner determined, "- - - these peanuts and also the roots to be heavily infected with the so-called smooth-headed meadow nematode." This species, Pratylenchus leiocephalus, was described originally on specimens of peanuts collected near Fairhope, Alabama (1). Other parasitic types Steiner found on the roots of plants from Albany were, " - - - two species of Aphelenchoides and a species of Dorylaimus as well as Seinura tenuicaudata."

Specimens of Spanish peanuts showing the dark pock marks on the shell were also collected near Experiment, Georgia. Some plants at this location appeared slightly chlorotic and stunted but differences in this respect were not as great as near Dawson. No distinct patches were apparent across this field.

Although the occurrence of badly pocked nuts appeared limited to the poorer plants, the occurrence of such plants was no assurance that the nuts would show infestation. Infested nuts were found most prevalent in the lower locations of the field. Drainage, which would tend to concentrate the population of nematodes, as well as a more favorable environment, might easily account for this distribution.

When submitted to Dr. Steiner, he found specimens from this field infested with the smooth-headed meadow nematode. He considered these to be, " - - - a variety of Pratylenchus leiocephalus, the form being exceptionally large and also otherwise differentiated." In addition to this meadow nematode, he also reported the occurrence of Xiphinema americanum in the material from this location.

A limited observation of large heavy shelled Virginia Bunch type nuts indicates that infestations in these are not as conspicuous as on the lighter shelled Spanish type. The pocks of infested tissue are more concealed by the generally heavier structure and tissues of these shells. In most cases, the pocks on these heavier shells were not readily evident until examined under a magnification of several times.

The extent of these nematodes through the peanut crop in this State is still problematic. Microscopic examinations of large populations of plants or soil samples from each field is a requisite when infested plants are without critical or distinctive macroscopic symptoms. Without such examination there is nothing to distinguish plants infested with nematodes from those suffering entirely because of improper soil maintenance, fungus infections or a generally poor environment.

There is evidence that the smooth-headed meadow nematode has occurred for some time in this State. Specimens of nuts collected near Columbus, Georgia, in 1927 and filed in the Experiment Station herbarium are comparable to the current collections. Infestation by these various nematodes has undoubtedly limited production. It appears, however, that whatever this limitation may be, it has been masked to the satisfaction of the average grower by use of fertilizers and good culture.

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GEORGIA AGRICULTURAL EXPERIMENT STATION, EXPERIMENT

BUNCHY TOP AND OTHER DISEASES OF ABACÁ AT TAWAU, MOSTYN AND SEBATIK ISLAND, BRITISH NORTH BORNEO

Otto A. Reinking

From August 22 through August 29, 1949, an intensive disease survey was made of the abacá (Manila hemp) growing on estates at Tawau, Mostyn, and on Sebatik Island, British North Borneo. A description of diseases found is presented.

Bunchy top of abacá was found to be present on the mainland. The only exact proof of bunchy top of abacá is transmission tests. Such tests were impossible during my survey. The fact that the true symptoms as I know them from abacá in the Philippines and bananas in Australia were all present appears to be sufficient for an accurate diagnosis. The identity is further substantiated by the same diagnosis made by Dr. C. J. P. Magee, known for his studies on banana bunchy top in Australia, and an expert fieldman, Mr. E. D. Foster, during inspection trips in Borneo.

No Panama disease (wilt) was found either on abacá or bananas and it is believed not be present in those areas investigated. Abacá is highly resistant to the Panama wilt but in a few cases has been noted to come down with the disease (2, 9, 11). Most of the abacá plantings made in Central America are on lands that have gone out with 100 percent banana Panama disease. The abacá under these conditions rarely takes the disease (11). Most of the cooking types of bananas in the Borneo regions visited, such as Pisang Raja and allied types, are resistant to Panama disease to a degree at least. Pisang Ejau, the green eating banana, is highly resistant. One would not expect to find Panama disease in these types. The Gros Michel grown in Central America is very susceptible, but it apparently is not present in this part of Borneo. No other diseases of importance were noted. Leaf spotting fungi were present but they were regarded as of little importance from a commercial standpoint.

Since bunchy top of abacá is the most important disease, a general review is herewith presented. All of the symptoms described were found in Borneo. The insect vector Pentalonia nigronervosa was present in all abacá plantations visited.

REVIEW OF BUNCHY TOP DISEASE OF ABACÁ

Hosts

Abacá and bananas are the only known hosts of bunchy top in various parts of the world. In the Philippines the strain of virus causing bunchy top of abacá could not be transmitted to bananas (6, 7). In Australia the strain of virus on bananas was reported to be transferrable to abacá (5). In Borneo bananas are affected with a trouble that in part appears to be similar to abacá bunchy top, but before it can be stated with certainty that this is true in all cases, it will have to be proved by transmission tests.

Symptoms

Early stage of disease on young plants. The group of diseased suckers arising from a diseased plant are usually stunted and may even show a rosetted growth of leaves. Individual affected leaves at first may have yellowish white, definite chlorotic areas on the blade of the youngest furled leaf (6). The leaves of young diseased plants are usually a darker green than normal leaves. The edges of such leaves turn upward, are often narrower than normal and frequently tear along the margin.

By transmitted light, distinct symptoms on the affected leaves are evident. This is a vein clearing producing transparent streaks. The vein clearing of the main veins extends from the mid-rib to the edges of the leaves and is very characteristic of abaca bunchy top. These transparent lines may be continuous on the main veins, but are often broken, especially in secondary veins. On the surface of such leaves yellow lines may or may not appear. In some plants, especially on older ones, dark green continuous or broken streaks may be present in the veins in place of transparent lines. A hooking or distinct curving downward of the diseased veins may develop where they approach the mid-rib in the adjoining lighter-colored area of the leaf blade.

Early stages of disease on the second or third leaf of older plants. In older plantings, typical leaf symptoms are present on the second or third youngest leaves. These leaves from a distance show a general yellowing, but on closer observation show a definite yellow and green streaking running from the mid-rib to the edges of the leaves. Frequently these streaks may be more prevalent near the tips of the leaves; however, they may extend further down the leaf.

When older, the streaks turn brownish, especially near the edges of the leaves. The edges of such leaves may turn upward. On closer observation, even seen from the ground on top leaves, a clear-cut vein clearing or white transparent veins may be seen by transmitted light. Leaves in this stage of disease are generally narrower than normal leaves and have upturned, slightly browned edges. The petiole and mid-rib of such leaves generally show a green streaking, usually in continuous lines.

Advanced stages of disease. The leaves in advanced cases are shorter and narrower and stiffer than normal and usually grow more upright and are curled upwards along the margins. The chlorotic areas on the margins of leaves may turn brown and die. Frequently the whole leaf blade turns brown and dies in an early stage of growth. Plants are stunted and a rosetted appearance of leaves is produced due to a stunting of the inner leaf sheaths of younger leaves which results in bunching of these leaves as they emerge from the upper portion of the pseudostem.

A bacterial heart-rot frequently is present in plants in advanced stages of bunchy top. The rotting is of a secondary nature produced by bacteria on the weakened tissues of bunchy top diseased plants.

Root symptoms on diseased plants. The roots of older infected plants at first show a browning then die and rot.

Length of life of diseased plants. Infected abacá plants remain alive for from two to two and one-half years after they become infected. The plants gradually become smaller and smaller and finally die. Diseased plants usually do not fruit.

Recovery of diseased plants. No cases of recovery have ever been recorded.

Cause and Method of Transmission

Bunchy top of abaca is caused by a virus named Marmor abaca Holmes (4, 6, 7).

The virus is transmitted in the field only by an aphid named Pentalonia nigronervosa Coq. (6, 7). In experimental transmission experiments, a closely related species of aphid, Pentalonia caladii van der Goot, was induced to transmit the disease (3). This aphid probably is not a factor in the field spread.

Pentalonia nigronervosa must feed on diseased abaca for 12 hours to obtain the virus. In addition, the virus requires an incubation period of 24 to 48 hours in the body of the aphid before it can be transmitted to abaca (6).

The virus in aphid mothers is not transmitted to the offspring. The young aphids must feed anew on infected plants before they can infect healthy abaca plants (6).

Once it acquires the virus, Pentalonia nigronervosa retains it as long as it lives (4, 6).

The virus of abacá, therefore, belongs to the persistent type of viruses. According to Jensen (4), these viruses have the following characteristics: They usually require a latent or incubation period in the body of the insect vector; after becoming viruliferous the insect vectors usually retain the virus for an extended period of time or for life without the need of again feeding on a diseased plant; the vectors are usually phloem feeders and the viruses usually produce symptoms which are associated with phloem disturbances; most persistent viruses are not sap-transmissible and there is a greater degree of specificity between the insect vector and the virus than occurs among the non-persistent viruses.

A single aphid can acquire a sufficient amount of virus to infect a young abacá plant (6).

In laboratory tests it has been shown (6) that the aphids can transmit the virus through the roots. It is believed that this method of transmission is not important in the field.

Other Disease Factors That May Have a Bearing on Control

1. The virus is systemic, that is it is spread throughout the plant in the vascular tissues, traveling from mother to daughter plants. When once infected the whole stool remains infected.
2. The virus is spread by aphids and by transplanting diseased planting material.
3. The aphids are spread in abacá fields by being carried from plant to plant by ants which live in a symbiotic manner with the aphids and by the winged forms of the aphids which may fly from plant to plant or be carried long distances by the wind. In Australia it is believed that the winged forms of aphids of banana bunchy top, which are the same as the abacá bunchy top aphids, may be picked up by air currents and carried for miles (5).
4. The bunchy top aphids are widespread and common in all abaca estates visited in Borneo.
5. A diseased rhizome (head), or eye or sucker from a diseased plant if planted always will transmit disease. When a plant is once diseased it remains so throughout its life.

6. In a replanting project only absolutely disease-free planting material should be used.

7. In early stages of infection not all plants in an affected stool may show disease symptoms. It is not advisable to use healthy appearing plants from such stools for planting material.

8. No cases of disease recovery have been noted in field or greenhouse.

9. Diseased plants usually continue growing for two or more years. They gradually become stunted and finally die.

10. Diseased plants have not been observed to fruit.

11. The virus is not carried in the seed.

12. All commercial varieties of abaca are susceptible, some to a lesser degree than others. Tangongon, Maguindanao, and Bongolanon are all susceptible.

13. The virus does not live in the soil nor is it transmitted through the soil, even though the aphids might remain in the soil for a limited period.

14. The virus is not transmitted by sap injections or by insertion of crushed diseased material into healthy plants. It is not transmitted from diseased to healthy plants by knives or other implements.

15. The period of incubation of disease, or the time required for disease appearance from the time of infection by aphids, has been determined to be 18 to 28 days in true seedling plants and on older plants to take from three to four and one-half months (6). The period of incubation is shorter in fast-growing than in slow-growing plants.

16. In Borneo it is not certain that one of the apparent viruses on banana is the same as that causing abacá bunchy top. Until this point is determined, no bananas should be planted near abacá.

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NEW YORK STATE AGRICULTURAL EXPERIMENT STATION, GENEVA

BANANA VIRUS STUDIES AND OBSERVATIONS MADE AT TAWAU, SEMPORNA, MOSTYN, AND SEBATIK ISLAND, BRITISH NORTH BORNEO: SUGGESTED STUDIES FOR INVESTIGATIONS TO CLARIFY THE ABACÁ BUNCHY-TOP RELATIONSHIP WITH THE BANANA VIRUS COMPLEX

Otto A. Reinking

During August, 1949, the writer had an opportunity to study and observe various apparently virus troubles of bananas growing on the east coast of British North Borneo. These studies were made while investigating the bunchy top of abacá present in that region. The exact identity of the various banana virus troubles can be determined only by transmission studies which obviously were not possible during a short visit. The presence of these apparently virus troubles on bananas growing in the vicinity of bunchy-top diseased abacá brings up a number of questions that may be vital to the abaca industry and to the economy of the natives who use bananas as an important food in their diet. A detailed study of the banana troubles should be conducted to determine whether the observations noted here all are really of a virus nature and what relation these troubles may have to the bunchy-top virus of abacá as it occurs in Borneo. The present paper will deal only with the symptoms of apparent disease and the host plants upon which these troubles occurred, along with references to virus troubles reported elsewhere which seem to have a bearing on the banana troubles in Borneo.

Suggestions for possible research to be conducted have been included as a conclusion. These suggestions have been made primarily from a standpoint of control of bunchy top of abacá in order to clarify the questions of the possible identitity between viruses causing troubles on both abacá and banana, and the presence of non-related viruses on each plant. It may be that the bunchy-top virus of abacá also is present on bananas in Borneo, as has been reported by Magee in Australia (6). In the Philippine Islands, the bunchy-top strain of virus on abacá has never been transmitted to banana varieties (11).

It appears, therefore, that there are two bunchy-top virus strains of abacá, one strain in Australia on bananas, that goes over to abacá, and one strain in the Philippine Islands, that is wholly confined to abacá. The identity of the abacá bunchy-top virus strain present in Borneo and the question of its ability to go over to banana should be definitely determined. From my observations, it appears that there are distinct virus troubles of bananas and that possibly the bunchy-top virus of abacá also may be capable of going over to bananas. Such points can only be determined by transmission experiments. To me, such studies appear to be the most important investigations to be conducted from the standpoint of bunchy-top control of abacá in British North Borneo.

DESCRIPTION OF BANANA TROUBLES OBSERVED

Banana Mosaic (?)

Location of Plants. Tawau, British North Borneo.

Symptoms. Chlorotic streaks of yellow and green running from the mid-rib to the edge of the leaf are developed on the affected leaf blades. In older leaves, the elongated streaks may become necrotic.

By transmitted light, an approach to a vein clearing of the main veins running from the mid-rib to the edge of the leaf blade was evident. In the chlorotic streaks, a hooking or bending of the veins developed in the light-colored streak adjacent to the mid-rib. This symptom may be present in abaca bunchy-top diseased plants.

Short chlorotic streaks were developed on the mid-rib of younger leaves.

The older leaves of the diseased banana variety turned a brilliant yellow. This, however, possibly was due to the effects of a weakened plant and not to a virus.

The suckers of the affected stool were stunted and the older plants in the stool had collapsed and succumbed to a bacterial rot. A heart rot was reported by Magee (7) in Australia to often accompany infectious chlorosis of banana. It was reported that two months ago the whole group of plants had healthy green goliage on 50 percent of the plants. When observed, however, the main part of the group of plants had collapsed without bearing fruit. This procedure was reported to have taken place repeatedly during the past year.

Secondary Host (?). At the base of the banana plant, the blue-flowered wandering Jew, Commelina nudiflora, was growing in profusion. The leaves of this plant were badly affected with a white or pale green diamond-shaped mosaic pattern.

Remarks. A similar banana mosaic has been described from Honolulu (5) even to the presence of a mosaic-infected Commelina, but in this case no transmission experiments were conducted. The occurrence of the disease elsewhere has been summarized by Jensen (5). Apparently, two strains of a virus obtained from Commelina nudiflora have been described (5). Transmission experiments have shown the following plants to be susceptible to the Commelina viruses: Celery, pepper, banana, and corn (5). Both Aphis maidis and Aphis gossypii have been shown capable of transmitting the virus.

In Brazil (12), a similar virus disease of banana and Commelina nudiflora has been described. Transmission experiments showed that the virus from each of these plants could be transmitted to solanaceous plants in which similar disease symptoms were produced.

The viruses obtained from Commelina nudiflora have been classified as strains of cucumber mosaic virus (5). If the disease in Borneo described above proves to be the same, it obviously cannot be the abacá bunchy-top virus.

That the disease described on banana in Borneo is identical to the above, of course, has not been demonstrated. The importance of further investigations on this Borneo banana mosaic is clearly indicated. An exact determination should be made on the identity of this and similar troubles.

Infectious Chlorosis (?)

Location of Plant. The plant from which this description was made is located at Tawau, British North Borneo. A number of other plants with similar symptoms were observed, on bananas, but the trouble did not appear to be widespread.

Symptoms. Distinct, clear-cut, chlorotic streaks of yellowish and green are produced on the leaf blade running from the mid-rib to the edge of the leaf. The streaks were more prevalent near the upper half of the leaf. A slight crinkling of the leaf appeared to be produced. No other symptoms on the petiole or mid-rib were noted. A slight clearing of veins apparently was produced in the main veins running from the mid-rib to the edge of the leaf in the chlorotic streaks.

The plant did not appear to be stunted or otherwise affected. Not enough detailed studies, however, were made to give a complete description of the symptoms or effect upon the plant. No evidence of a heart-rot stage was observed as reported by Magee (7) in Australia.

Remarks. This disease is interesting as it more nearly resembles mosaic on abacá as found in Davao, P. I. (11), than any other trouble noted on bananas. In the Davao region of the Philippine Islands where abacá mosaic is serious, the disease has not been noted on bananas. Evidently, the two troubles are distinct. Calinisan (1) in the Philippines thought that the mosaic disease of abacá in the Philippines is similar to, if not closely identical with, the new virus disease of banana reported by Magee (7) in Australia. Magee (7) reported a heart-rot stage which accompanied the disease. This stage was not observed in Borneo during the meager study. The disease is not widespread in Australia, but Magee stated that if it did become severe, it might be a great threat to the industry. He thought it was transmitted by the banana aphid, Pentalonia nigronervosa. The latter point should be verified.

According to the above evidence, one might judge, in a round-about way, that the trouble on banana might be the same as mosaic on abacá. This is not probable, but the point needs clarification. It also should be determined what relationship this disease has to banana mosaic and other banana troubles described in this report. The need for clarification of these points is evident.

A similar type of disease, or possibly more nearly resembling the next discussed banana bunchy-top complex, was observed on wild banana varieties growing along the road in a jungle area near Tawau. This trouble needs study to prove first that it is a virus trouble and, secondly, if a virus, to what complex it belongs.

Banana Bunchy-Top Complex

Location of Plants. Banana plants apparently affected with a virus disease that, to a certain extent, resembles bunchy top of bananas in Australia and abaca in Borneo were observed in the following regions: Tawau, back of Semporna, and at Mostyn on the mainland of British North Borneo; and on Sebatik Island across the bay from Tawan.

Symptoms. Diseased plants may show a general yellowing of younger and older leaves. Individual leaves have chlorotic streaks of yellowish and green on the leaf blade extending from the mid-rib to the edge of the leaf. This streaking generally is not so uniform as that described

for infectious chlorosis, although it may be more general. A moderate clearing of veins is present in the main veins running across the leaf blade from the mid-rib to the edge of the leaf. The production of hooks in the veins of chlorotic streaks where they join the mid-rib is generally more pronounced as it is in abacá bunchy top. Dark green to brown broken streaks may be present in affected veins of leaves with chlorotic streaks. In addition to these leaf characters, dark streaks may be produced on the leaf petiole. These most frequently are not continuous but broken. Badly affected plants are stunted and have an abnormal number of yellowed and browned leaves.

Remarks. This disease complex of bananas has been stated to be the same as the bunchy top of abacá. It certainly more nearly resembles this trouble than that of the other banana troubles described. Because from symptoms alone a positive identification cannot be made, transmission experiments will have to be conducted. In Australia (6), bunchy top of bananas has been reported as being transmitted to abacá. In the Philippine Islands (9), no transmission from abacá to bananas could be accomplished. Apparently, two different virus strains exist in each country. If the banana disease in Borneo goes over to abacá and vice versa producing bunchy top in each plant, a control will have to be based on these findings. If not, the banana can be eliminated from the picture of control. Until, however, this point is clarified, bananas will have to be suspected and eradicated along with abacá in any general control practice for bunchy top.

It is possible that a number of diseased bananas described under this category may fall into one or the other of the first two described banana symptoms. It is possible that all may be found to belong to one disease complex.

Here again the need of transmission experiments is pertinent to a full understanding of the problem. Because of the confused picture between abacá bunchy top and the various probable banana virus troubles described, the following suggestions for further research have been given. It is believed that enough basic studies have been made elsewhere on abacá bunchy top and that further studies should be confined to an investigation of the banana troubles and their possible relationships with abacá. However, further studies may be needed to determine whether more than one virus is present in some cases of bunchy top of abacá.

RESEARCH PROBLEMS OF FIRST IMPORTANCE IN BORNEO

(1) Identity of banana viruses described on Borneo bananas (cultivated and wild) should be established by transmission experiments. It should be determined whether these virus troubles are all the same or if more than one virus trouble is present.

(2) The ability of various banana virus strains to go over to abacá should be established. The use of different aphid carriers may be essential (3, 11).

(3) The identity of the abacá bunchy-top virus strain present in Borneo and the question of its ability to go over to banana should be definitely established. It should be determined whether the Australian or Philippine complex is present.

(4) The question of a possible combination of more than one virus present in abacá bunchy top should be checked. Separation of two possible viruses is accomplished by use of different aphid vectors (11).

(5) Aphid studies on both wild and cultivated bananas should be made. The use of different aphids may be necessary to establish identity of some of the banana viruses and ability of these viruses to go over to abacá. Our present knowledge shows that abacá bunchy top and banana bunchy top are transmitted only by Pentalonia nigronervosa (6, 8), with the possible exception that a related species, Pentalonia caladii van der Goot may be able to transmit bunchy top of abacá in the Philippines (4). The bunchy top aphid or other aphids may be found to carry the possible banana viruses. Mosaic of abacá in the Philippines has been transmitted by the following aphids: Aphis gossypii, Aphis maidis, Rhopalosiphum nymphae, and Rhopalosiphum sp. (probably prunifoliae) (2, 3, 5, 10, 11). It might be necessary to use some of these aphids for transmission of the banana troubles, especially the one listed as banana mosaic, if this is found to be similar to the diseases described as being present in Hawaii and Brasil (5, 12).

(6) It may be possible to conduct all transmission studies with abacá on seedling plants (8, 9, 11). Transmission to bananas will have to be done primarily using suckers as accomplished in Australia (6). The use of banana plants grown from seed-producing bananas may be tried. The susceptibility of these banana species will have to be determined, to be certain they are susceptible before general use can be made of the same.

(7) It would not be necessary to establish an elaborate greenhouse for the preliminary transmission studies if such studies are conducted in an isolated place. The use of screen cages

and cheesecloth for these tests gives ample protection. For later, more detailed and absolutely checked investigations, it would be best to have a small, well-screened greenhouse.

(8) A laboratory and experimental grounds could be established in Tawau, British North Borneo. Such a location would be well isolated from abacá plantings and could be isolated from banana plantings. At the same time, it would be in the vicinity of the disease problems to be studied.

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NEW YORK STATE AGRICULTURAL EXPERIMENT STATION, GENEVA

HERBARIUM RECORDS OF PELLICULARIA FILAMENTOSA ON HEVEA RUBBER

John A. Stevenson and J. B. Carpenter

A recent examination of the specimens of the target leaf spot disease on Hevea, caused by Pellicularia filamentosa (Pat.) Rogers, in the Mycological Collections of the Bureau of Plant Industry, Soils, and Agricultural Engineering has revealed a number of unpublished records that broaden the known geographic distribution of target spot and antedate published records in other localities. In addition, an examination of the Hevea collections in the Phanerogamic Collections of the Bureau of Plant Industry, Soils, and Agricultural Engineering and of the United States National Herbarium has yielded one record of the disease from Bolivia as cited below. A list of the collections is presented here, arranged by countries and chronologically, for it is felt that the information may be useful to persons working with this and similar leaf diseases. Hevea brasiliensis (H.B.K.) Muell.-Arg. is the host plant except where noted otherwise. Collections made on specific clones are identified as such.

BOLIVIA: ISAPURI: Oct. 14, 1901 (A putative hybrid of H. brasiliensis X H. guianensis Aubl. var. lutea (Spruce ex Benth.) Ducke & Schultes det. by R. J. Seibert) R. S. Williams 1658. EX phanerogamic specimen No. 1175140 in the United States National Herbarium. This is the first known record of the disease on Hevea.

BRAZIL: BELEM: Oct. 1941, designated as "target leaf spot of Hevea", Butler 7051; Aug. 29, 1942, Archer H-455; Feb. 13, 1945, Archer H-463; May, 1945, Langford s.n. BELTERRA: May, 1943, Townsend s.n.; Mar. 23, 1945, Langford s.n.

COSTA RICA: TURRIALBA: Dec. 1947, clone FX-1041, Langford & Carpenter 159; July 1949, clone FX-642 (H. benthamiana Muell.-Arg. X H. brasiliensis), Langford & Carpenter 160.

HONDURAS: LANCETILLA: May 27, 1941, clone GV-42, Stanwood 6030.

PERU: AGUAYTIA (Plantation Yurac No. 1): Apr. 27, 1944, Seibert 1918, 1919, 1920; July 11, 1945, Rands 4; July 11, 1945, Rands 5; July 12, 1945, clone F-6395 (H. brasiliensis X H. spruceana (Benth.) Muell.-Arg.), Rands 3; July 12, 1945, H. guianensis var. lutea, Rands 2; Feb. 18, 1947, Carpenter 63. IQUITOS: July 1942, Russell 8002; Nov. 20, 1946, Carpenter 55; Nov. 21, 1946, clone GX-26, Carpenter 57. OROMINA: Mar. 15, 1947, Carpenter 66. SANTA MARIA (Plantation Yurimaguas No. 2); Nov. 22, 1946, Carpenter 56. TINGO MARIA: Oct. 25, 1942, Russell 1; April 12, 1944, Lorenz (T. M. Accession Nos.) 3210, 3211; Apr. 15, 1944, Crandall s.n.; Nov. 1944, Crandall (T. M. Accession No.) 3221; June 2, 1948, H. guianensis var. lutea, Carpenter 94.

UNITED STATES: BELTSVILLE, MD.: July 7, 1944, diseased leaves resulting from greenhouse inoculations, Kotila s.n.

DIVISION OF MYCOLOGY AND DISEASE SURVEY AND DIVISION OF RUBBER PLANT INVESTIGATIONS, BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING

EARLY DEVELOPMENT OF APPLE SCAB

APPLE SCAB DEVELOPMENT IN DELAWARE: Examination of overwintered leaves collected on January 27 at Dover, Delaware, showed that ascospores were fully formed in some of the asci. On leaves collected at the same location on February 6, fully mature colored ascospores were found in asci in several perithecia. This is the earliest development of ascospores on record in Delaware, insofar as the writers know.

January temperatures averaged 10.5° above normal and rainfall was abundant.

Indications point to early discharge of ascospores in Delaware. As the trees are still dormant, this early discharge may not be harmful.--J. W. Heuberger, P. L. Poulos, and J. J. Hood, University of Delaware, Newark

APPLE SCAB FUNGUS ESTABLISHES RECORD IN ILLINOIS: On ground hog day (February 2) I found a few perithecia of Venturia inaequalis showing several asci with mature (brown) ascospores. These were collected at Urbana, Illinois on Jonathan leaves. A mild winter combined with the exceptionally warm weather during January probably accounts for the early development and maturity of the ascospores. Most of the asci were well advanced for this time of year; the ascospores were formed and the asci extended rapidly when the perithecia were crushed. It is not anticipated that this early development will result in ascospore discharge before the buds open. Perithecia seem to be very abundant on apple leaves this year in spite of the fact that apple scab was not especially severe in the Urbana region in 1949.

This early date constitutes a record for Illinois although in 1942 mature ascospores were found on February 5. The record previous to this was February 22. In 1942, I recorded "In December (1941) there were 18 days with maximum temperature above 40° and 13 days above 50°; in January there were 18 days with maximums above 40 and 10 days above 45." Thus, weather conditions in 1942 were much like those in 1949-50 except that much higher maximums occurred in January 1950.--H. W. Anderson, University of Illinois, Urbana

OBSERVATIONS ON THE BAYOUD DISEASE OF DATE PALMS IN MOROCCO[1]

Roy W. Nixon

In March 1949, while engaged in an ecological study of date varieties in French North Africa under a Fellowship of the Guggenheim Foundation, the writer had an opportunity to visit the date country of southern Morocco. Along the valley of the Ziz River, the lower part of which is known as the Tafilelt, there was once a flourishing date industry. This was the home of the famous Medjool date variety, formerly exported in some quantity to England, Spain, and other countries of Europe, where it was well and favorably known to connoisseurs of rare fruits. But Medjool fruit is no longer exported from Morocco. Prior to about 1920 this variety is said to have constituted about 25 percent of the palms grown in the upper part of the area irrigated by the Ziz River. At the present time specimens of the Medjool are actually rather hard to find and, except in a few spots here and there, date palms no longer dominate the scene, but occur as scattered specimens in fields of grain or among plantings of olives which have to a considerable extent replaced them. In the region between Ksar Es-Souk and Erfoud the palm population has probably been reduced at least 50 percent. This transformation has resulted from the ravages of the bayoud disease, which is without doubt the most serious disease of date palms known anywhere in the world.

Unfortunately the best varieties appear to be most susceptible to the disease. The Medjool is already threatened with extinction. The Bou Feggous, probably the most widely planted variety in Morocco and in the nearby oases of western Algeria, is almost as susceptible and has been greatly reduced in numbers. As is often the case, one of the least esteemed varieties, Bou Slikhen, is said to be one of the most resistant. Miscellaneous inferior seedlings now con-

[1]The writer is indebted to several members of the Moroccan Department of Agriculture for courtesies in planning and making this trip: Monsieur Guillot, Directeur du Centre de Recherches Agronomiques; Monsieur Cuénot, Directeur du Service du Horticulture; Monsieur Billote, Agent de l'Agriculture; Monsieur Benson, Inspecteur-adjoint de Horticulture; and Monsieur Pereau-Leroy, Généticien de l'Institut des Fruits et Agrumes Coloniaux.

stitute the large majority of palms remaining. Perhaps date culture in this area can be built up again with new resistant varieties, but under modern conditions the possibility of growing other crops makes it doubtful that date culture will ever regain its former importance in many localities.

One of the most disheartening characteristics of the disease is that it appears to be most serious where soil and water conditions are most favorable for date culture. According to Dr. Georges Malençon, Inspecteur Principal de la Défense des Vegetaux (Division de la Production Agricole, Direction de l'Agriculture, du Commerce et des Forets), Rabat, Morocco, neglected palms in heavy soil with an inadequate supply of water may survive as long as two years after the appearance of visible symptoms. Thrifty palms, in lighter soils, with ample water often die within two months after the first symptoms appear. It is under these latter conditions in eastern Algeria and Tunisia that the famous Deglet Noor variety is grown to perfection and exported in quantity to other parts of the world. Should the bayoud ever reach this area the Deglet Noor Industry would probably be doomed.

There is no record of just when the disease first made its appearance. It may have been in the area irrigated by the Draa River in the extreme southern portion of Morocco for a century or more. From stories handed down by the natives a violent epidemic of the bayoud disease occurred there in the latter part of the last century. A large proportion of the palms are said to have been killed, but a few varieties and seedlings proved resistant and survived. In the course of time many of the missing palms were replaced with resistant types, so that the bayoud disease does relatively little damage in the valley of the Draa today.

Sometime around the turn of the century the disease had begun to move north and east. During the next thirty years it spread throughout the Tafilelt region and up the valley of the Ziz. It appeared at Bou Denib and at Figuig near the foothills of the northeast and finally reached the oases of Beni Ounif and Colomb Bechar along the western border of Algeria. More recently it has been found at In Salah, an oasis in southwestern Algeria which represents the extreme eastern point of its extension up to the present. It has not been found in any other date-growing region of the world. The progress of the disease has not been at a uniform rate but has been marked by violent outbreaks interspersed with periods of relative calm.

The word "bayoud" means white and is applied to the disease because of the characteristic color of affected leaves. The first symptom usually appears in late spring or early summer on a palm otherwise healthy to all outward appearances; a single leaf will turn white quite suddenly, sometimes in two days' time. This first white leaf, as seen by the writer, was one of the lower and older leaves on the palm, but March was too early to find many palms in this stage of the disease and it has been reported (3) that the first leaf affected may be situated anywhere in the crown. Usually the pinnae on one side of the leaf are affected first and their white color makes a striking contrast with the apparently normal pinnae on the other side. This condition persists for only a short time, however, as the entire leaf soon withers and the symptoms spread from leaf to leaf until the entire crown is affected and death results. Some leaves lose their green color more slowly, and gradually become yellowish, with long, irregular brown streaks along the rachis.

The bayoud disease has been described in French by Maire and Killian (4) and Chabrolin (2), and in English by Swingle (6) and Fawcett (3). The causal organism as well as the mode of spread was long in doubt. Infection through wounds was suspected. Flowers were thought to play some role in its spread. In recent years Dr. Malençon has been accumulating evidence that the causal agent is Fusarium albedinis (Killian and R. Maire) Malencon. From experimental inoculations and field studies Malençon (5) reports that the disease is most commonly transmitted through the roots and that man is believed to have been the chief vector in the occasional long jumps it has made in the course of its spread. The fungus survives for months in date wood and leaf midribs and, of course, would be easily transmitted by offshoots from affected palms.

No remedy for the disease has yet been discovered, although the Service de la Defense des Végétaux of Morocco (1) offers a ray of hope in a recent announcement that promising results have been obtained with certain chemical injections, particularly a salt of oxyquinoline. Some affected palms are said to have recovered and a large proportion to have been benefited by the injections. Experimental work is being continued with the treatment of approximately 6000 palms in 1947 and 1948. However, it may be a good many years before any proven therapeutic technique can be worked out.

Meanwhile, the presence of the bayoud disease in Morocco and western Algeria is an ever-present threat to the very important and highly developed date industry of eastern Algeria and Tunisia, and indirectly to all the date-growing areas of the world. The government of Algeria has imposed quarantines against the importation of date offshoots or any palm products from the infected areas, and it behooves other date-producing countries to keep a watchful eye on the

progress of the disease.

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SUSCEPTIBILITY OF SOME PEACH ROOTSTOCKS TO ROOT-KNOT NEMATODES

Leon Havis, B. G. Chitwood, V. E. Prince, G. S. Cobb, and A. L. Taylor[1]

The problem of root knot nematode damage to peach tree roots is one of the most serious ones faced by growers and nurserymen in the more southern States. Although the nematodes rarely cause direct death of the trees, they weaken the trees to such an extent that they are easily destroyed by other factors. Winter injury, drought, poor soil drainage, or other such factors, cause much more serious damage to trees whose roots are infected with nematodes. Efforts to control peach nematodes have been made through soil fumigation, the use of relatively resistant rootstocks, and by resistant cover crops. Fumigation methods have lacked permanence. The resistant rootstocks have been only partly satisfactory since even those first thought to be most resistant have proved to be susceptible to certain nematodes (2, 3).

This paper is a brief partial report of a detailed study of the relative susceptibility of some peach rootstocks to the two principal species of peach nematodes. The characteristics and identifications of these two species have been recently presented (1). Meloidogyne incognita[2], or so-called common peach nematode, is widely distributed on the peach and many other plants throughout the South. Roots of Shalil and Yunnan peaches show considerable resistance to this species. M. javanica is evidently not so widely distributed as M. incognita, but has caused serious damage to such nematode "resistant" peach rootstocks as Yunnan and Shalil in several regions.

Procedure

The tests here reported were conducted during the spring and summer of 1949 in the greenhouses of the Plant Industry Station, Beltsville, Maryland. Seedlings of six rootstocks were tested. These were Yunnan (P.I. 55886), S 37, Red Shadow, Davidson, Lovell, and a hybrid, Chico No. 16 (P.I. 146135) x Prunus davidiana (C-26712).[3] Yunnan is a well known "nematode resistant" variety which has been in use for several years, while S 37 is a variety which was patented (Plant Pat. No. 904) in December 1949 on the basis of the resistance of its seedlings to nematodes. Seeds of S 37 were obtained from Striblings Nursery, Merced, California who selected it from seedlings of the ornamental flowering peach (Prunus persica). Red Shadow and Davidson are red-leaved varieties which have been reported as relatively resistant to root knot nematodes in the field. Chico No. 16, one parent of the hybrid, seemed to be relatively resistant to M. incognita, while the other parent, Prunus davidiana has shown considerable resistance to M. javanica in previous studies (2). Lovell is the most commonly used peach rootstock and is known to be highly susceptible to root knot.

Inoculum of the two nematode species, M. incognita and M. javanica, was propagated in the greenhouse on roots of tomato plants. The roots of the tomato were rinsed and chopped finely and weighed. Then weighed samples of roots were examined to determine the number of egg masses per weighed unit of inoculum. Also, weighed samples of soil in which the tomatoes grew were used for inoculum after determining the egg masses per weighed unit. Thus, each pot of soil used for the peach seedlings was inoculated with an approximate known number of egg masses of one of the two species of nematode. We believe that this procedure is important to the success of this method of testing, and makes it possible to obtain significant differences between treatments with the use of relatively few plants.

The peach seeds were germinated in flats of sterile sand; then the seedlings were transplanted into 5-inch pots of soil containing one of the two species of nematode. Several examina-

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[1] Respectively, senior horticulturist, Division of Fruit and Vegetable Crops and Diseases; former associate nematologist, Division of Nematology, now associate Professor, The Catholic University of America; junior horticulturist, Division of Fruit and Vegetable Crops and Diseases; assistant nematologist; and nematologist, Division of Nematology, Bureau of Plant Industry, Soils, and Agricultural Engineering, Agricultural Research Administration, U. S. Department of Agriculture, Beltsville, Maryland.

[2] The root knot nematode species Heterodera marioni has been shown to be a group of several species, differing from each other morphologically as well as in reaction to various host plants. The generic name, Meloidogyne, has been revived and appropriate specific names applied.

[3] Cross made by Mr. Lloyd Joley, U. S. Plant Introduction Garden, Chico, California, for this purpose.

tions of the seedling roots were made during their growth, data from which are not given in detail here. The plants were fertilized and watered as needed to maintain vigorous growth. In early July the seedlings were transferred to 10-inch pots where they grew until the final examination in September.

Plants that had grown in nematode infested soil from March until September were removed and the roots examined for galling. A visual Root Gall Index, using grades from 0 to 5 in order of number of galls per given weight of roots, was determined. Then 2-gram samples of roots from each plant were obtained and later examined for number of egg masses and number of females.

Results

The results reported here are only a part of a much more detailed study which is not yet completed. Some of these results were so striking that we feel they should be reported. Several rates of inoculation with the two nematode species were used, but they are grouped together for this report.

Table 1. The relative amount of root galling (Root Gall Index) of seedlings of six rootstocks infected with two nematode species. (Root Gall Index numbered 0 to 5 in order of increasing severity of galling).

Rootstocks variety	No. of samples (seedlings)	Nematode species	Root Gall Index
Lovell	5	None (control)	0.2*
"	11	Meloidogyne incognita	3.3
"	10	Meloidogyne javanica	2.3
Yunnan	6	None (control)	0.0
"	10	M. incognita	0.8
"	10	M. javanica	3.1
S 37	6	None (control)	0.0
"	13	M. incognita	1.2
"	14	M. javanica	1.4
Red Shadow	6	None (control)	0.2*
"	7	M. incognita	3.7
"	5	M. javanica	2.4
Davidson	6	None (control)	0.0
"	7	M. incognita	3.6
"	7	M. javanica	2.6
P.I. 146135 (Chico No. 16) x C-26712 (Prunus davidiana)	6	None (control)	0.0
	9	M. incognita	0.8
	8	M. javanica	2.1

* One plant infected by contamination.

The Root Gall Index (Table 1) is a result of a detailed visual examination of the roots of each peach seedling after it had grown six months in the infested soil. This is only a fairly good measure of potential root damage. In this rating of 0 to 5 in order of increasing severity of galling, a rating of 2.0 or above may be considered as relatively severe. It may be noted (Table 1) that the Lovell, Red Shadow, and Davidson varieties showed relatively severe galling from both the M. incognita and the M. javanica species. M. incognita caused very little galling of roots of Yunnan and the hybrid, P.I. 146135 x Prunus davidiana. M. javanica, however, caused considerable galling in these varieties. The hybrid seedlings showed much variation among individuals, which is encouraging from the standpoint of development of resistant stocks through breeding. The S 37 variety showed very few galls on the roots in soil inoculated with either of the two nematode species. As a rule M. incognita causes larger galls than M.

javanica; hence, plants suffering from the same number of nematodes may be given different visual gall ratings.

It was very important in these studies, in addition to determining the amount of galling of the roots, to determine the relative reproduction rate of the two species of nematodes on the different peach varieties. This determination, made by counting egg masses and number of females in a 2-gram root sample of each plant, is reported here (Table 2) for the six different rootstocks. It will be noted (Table 2) that the nematode reproduction rate of M. incognita was relatively high in Lovell roots, but that there was also considerable reproduction of M. javanica there. In the Yunnan there was no reproduction of the "common race," or M. incognita, but very high reproduction of the "Yunnan race," or M. javanica.

Table 2. The average number of egg masses and females in a 2-gram (1 plant) root sample from seedlings of three rootstocks and two nematode species.

Rootstock	No. of samples (seedlings)	Nematode species	No. of females	No. of egg masses
Lovell	10	M. incognita	106	5.9
"	8	M. javanica	23	2.8
Yunnan	10	M. incognita	0.25	0.0
"	8	M. javanica	80	8.0
S 37	12	M. incognita	0.6*	0.25*
"	8	M. javanica	0.2	0.0
Red Shadow	7	M. incognita	44.0	4.7
"	5	M. javanica	7.6	0.0
Davidson	7	M. incognita	58	1.7
"	6	M. javanica	23	0.17
P.I. 146135 (Chico No. 16) x C-26712 (Prunus davidiana)	8	M. incognita	0.0	0.0
	8	M. javanica	32	1.5

* All found in one sample (roots from one plant); thus, it may have been due to either a mistake in labeling or to variation among seedlings.

Variety S 37, in addition to indicating a low galling index (Table 1) showed an extremely low reproduction rate of both nematodes. It is noteworthy that the few egg masses and females found here were all in one 2-gram sample of roots from a single plant. This then may have been a mistake in labeling, or it may be due to genetic differences between plants.

The seedlings of the red-leaved varieties, Red Shadow and Davidson, both showed some reproduction of the two different species of nematodes. In both varieties there was more reproduction shown for M. incognita than M. javanica. The hybrid seedlings indicated no reproduction of the "common" species (M. incognita) but considerable reproduction of the M. javanica as an average. In some individual seedlings, however, there was no reproduction, and there was much variation among the other plants of this rootstock.

Conclusions

Under the conditions of these tests the S 37 rootstock variety showed a high degree of resistance to the two species of nematode which commonly attack peach roots. The fact that it was highly resistant to M. javanica, the nematode species which causes serious damage to Yunnan rootstocks, is especially important. Variety S 37 has not yet been used long enough nor extensively enough for much information to be available on its value as a rootstock otherwise. Such factors as the vigor, length of life, productiveness, and winter injury of orchard trees on this stock should be determined. Furthermore, it is possible that the S 37 variety may be found susceptible to other races or species of root knot nematodes now present in some areas.

The evidence here that S 37 appears to be highly resistant to both Meloidogyne incognita and M. javanica does not mean that the growth of plants of this variety cannot be affected by these nematodes. As we have found in many plants with various nematodes, heavy soil populations may cause plant injury even though the nematode population cannot maintain itself on the particular plant. This need not be a highly important factor in practical use. Since the variety seems so highly resistant, damage to seedlings and to young trees in the field should be prevented by soil fumigation before planting, while damage to older trees should be prevented by the use of cover crops resistant to root knot.

The great variability in resistance to the two nematode species shown by the hybrid seedling stock is encouraging. It may well be that through modern breeding methods nematode resistant stocks giving good orchard trees can be developed as they are needed. Further work is being done on this problem.

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A PROGRESS REPORT ON THE EXPERIMENTAL APPLICATION OF DUSTS AND SPRAYS TO CABBAGE SEED PLANTS FOR CONTROL OF SCLEROTINIA STALK ROT[1]

D. M. McLean

Observations during several seasons of stalk rot infections, caused by Sclerotinia sclerotiorum, on cabbage plants grown for seed production have correlated stalk infections with foliar infections resulting after petal fall following pollination.[2] Primary infections often occur at the base of leaves, or in areas on the leaves where the fallen petals might accumulate during periods of precipitation. The fungus invades the stalks from these primary foliar infections. Cabbage varieties highly susceptible to Mycosphaerella brassicicola are often defoliated in the spring before Sclerotinia stalk infections are most severe. These varieties are less affected by the stalk rot organism. Stalk infections usually occur at the point of attachment of leaves or branches. Infections are initiated by wind-blown ascospores liberated from apothecia which develop from soil-borne sclerotia.

In the 1949 experimental Sclerotinia control plot, cabbage seed plants in four replicated 100-foot rows were defoliated by removing the leaves on the stalks and branches just before the flowering period. Adjacent rows of the same number of plants were not defoliated. Just before the plants were cut for harvest, a count was made of the total centers of infection on the defoliated and undefoliated plants. These figures are presented in Table 1. It is apparent that foliar infections have an important influence on the total number of stalk infections. Also, this observation indicates that control might be obtained through foliar applications of fungicides.

Table 1. Control of Sclerotinia Stalk Rot in Cabbage Seed Plants, Mount Vernon, Washington, 1949.

Materials Used (Sprays)	Total Centers of Infection*	Mean Number of Centers of Infection	Percentage of total plants Infected*
Dithane Z-78	103	25.75	12.8
Zerlate	135	33.75	16.1
Fermate	169	42.75	20.0
Puratized	216	54.00	25.0
Kolofog	296	74.00	38.3
Untreated Check	482	120.50	59.7
Defoliated	20	5.00	11.4
Not defoliated	110	29.75	55.5

* 4 replications

Several years' investigation on the control of Sclerotinia by fungicidal dusting and spraying has failed to give significant control, owing primarily to the difficulty of getting thorough coverage on the plants. No provision is made in commercial cabbage seed fields for the accommodation of ground equipment for spraying or dusting adequate for thorough application of fungicides.

During 1949 five materials were applied as sprays with power-driven equipment at 250 pounds pressure, and five materials as dusts with a tractor-mounted, motor-driven, Messenger duster, to experimental cabbage seed plants. Each material was applied to randomized 4-row plots in 4 blocks. Plots were 100 feet in length with 4 feet between rows and 18 inches between plants in the row. The materials were applied from drive rows separating each block. At the time the plants were cut, prior to harvest, a count was made of the total centers of infection in the treated and untreated plots. These figures for the spray tests are presented in Table 1.

[1]Cooperative investigations of the Division of Fruit and Vegetable Crops and Diseases and the Northwest Washington Agricultural Experiment Station. Published as Scientific Paper No. 898, Washington Agricultural Experiment Stations, Institute of Agricultural Sciences, State College of Washington, Pullman.

[2]Occurrence of Sclerotinia stalk rot in cabbage seed plants in Skagit County, Washington, in 1948. Plant Dis. Reptr. 33, No. 5, May 15, 1949.

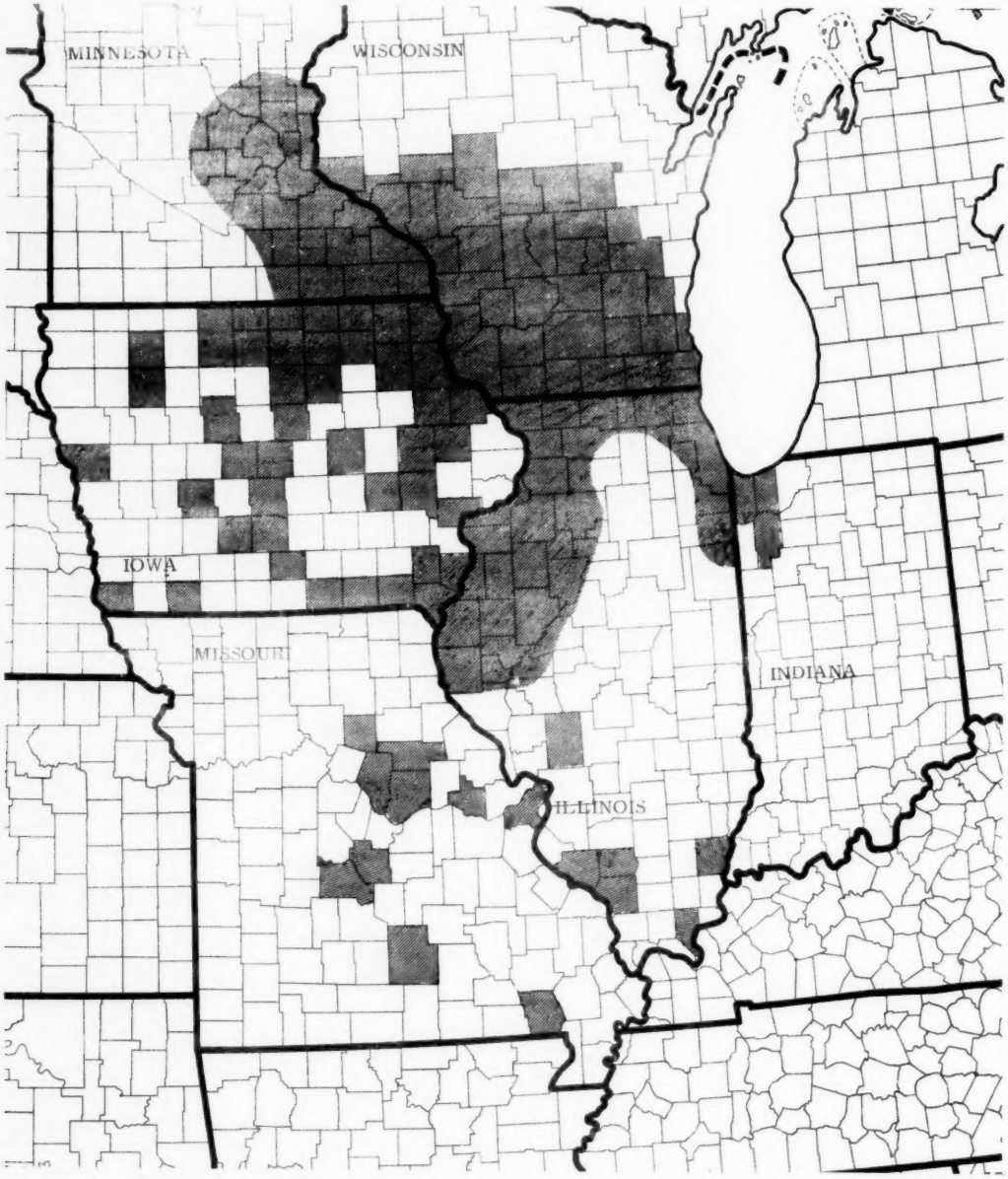
Owing to the irregularity of infection in any field, figures for total centers of infection are difficult to analyze.

Dust treatments consisted of Copper oxychloride, sulfate, Fermate, Kolodust, Zerlate, and Dithane Z-78. The figures for total centers of infection in the replicated treatments were not consistent enough to indicate any trend toward control.

It is felt that control might be obtained by proper timing of spray applications, with plants spaced to enable a thorough coverage with fungicides. The 1950 plots are set up in such a way that individual plants may be sprayed in double rows from tractor-drawn power equipment.

DIVISION OF FRUIT AND VEGETABLE CROPS AND DISEASES, BUREAU OF PLANT INDUSTRY, SOILS, AND AGRICULTURAL ENGINEERING, AND WASHINGTON AGRICULTURAL EXPERIMENT STATION

DISTRIBUTION OF OAK WILT IN THE UNITED STATES



KNOWN DISTRIBUTION OF OAK WILT CAUSED BY CHALARA QUERCINA HENRY IN THE UNITED STATES JANUARY 1950. MAP COMPILED FROM STATE REPORTS TO THE DIVISION OF FOREST PATHOLOGY.

OAK WILT IN ILLINOIS

J. C. Carter

The first proved case in Illinois of the oak wilt disease caused by Chalara quercina Henry was found on July 2, 1942. This diseased tree was a large northern red oak (Quercus borealis maxima Ashe) in Ingersol Park at Rockford in Winnebago County.

Figure 1. Dying of oaks caused by oak wilt in a grove of black oaks near Beardstown, Illinois, 1948.

Between 1942 and 1945, oak wilt made its appearance throughout much of that part of Illinois lying north and west of the Rock River. In 1945, two northern red oaks affected with oak wilt were found in a private wood lot located about two miles northwest of Peoria (Peoria County). In 1946, diseased oaks were found in the vicinity of Fox River Grove (McHenry County), Oregon and Grand Detour (Ogle County), Dixon (Lee County), Spring Valley and Bureau (Bureau County), Havana and Bath (Mason County), Chandlerville (Cass County) and Jacksonville (Morgan County). In the Peoria Park District (Peoria County), dying oaks were found in several isolated places in Detweiller Park and in two places along Grand View Drive. In 1947, dying oaks were found at Elburn (Kane County) and along the Rock River 10 miles south of Rockford. Also, additional dying trees were observed in Ingersol Park at Rockford.

In 1948, great numbers of oaks were dying in the vicinity of Beardstown (Cass County) in west central Illinois, and scattered diseased oaks were observed in the vicinities of Versailles (Brown County), Lima (Adams County) and Oquawka (Henderson County). Also, by means of laboratory culture tests in 1948, the presence of oak wilt was established in the vicinities of Crystal Lake (McHenry County), Willow Springs (Cook County), and Aroma Park (Kankakee County) in northeastern Illinois and near Red Bud (Randolph County), Willisville (Perry County), and Murphysboro and Carbondale (Jackson County) in southwestern Illinois. In 1949, oak wilt had spread to the vicinities of Elgin and Starks (Kane County), Algonquin (McHenry County) and Belvidere (Boone County) in northeastern Illinois. Laboratory culture tests this same year established the occurrence of the disease in the vicinities of Wheaton (DuPage County) in northeastern Illinois, in Gillespie (Macoupin County), and in Dixon Springs (Pope County) and Endfield (White County) in southeastern Illinois.

Oak wilt is widespread and occurs generally in the northern area of Illinois shaded on the map (page 80). In southern Illinois, spotted occurrences extend its range southward and eastward.

Bur oaks infected with wilt, which are reported generally to die slowly over a period of years, were observed to be dying within a single growing season in the vicinities of Aroma Park in 1948, Crystal Lake in 1948 and 1949, and Wheaton in 1949. In the rapidly dying bur oaks, extensive discoloration of the sapwood immediately beneath the bark appeared as brown to black streaks in the wilting branches.

An appreciation of the destruction caused by oak wilt may be obtained from the accompanying picture, (Figure 1) which was taken in 1948 in a grove of black oaks near Beardstown, Illinois.

Observations on Damage

In the Forest Preserve District of Cook County, oak wilt was first observed affecting two black oaks near Willow Springs in 1948. Mr. Noel B. Wysong, Chief Forester, reported that 72 trees located in six widely separated areas of the Forest Preserve District were affected with the disease in 1949. The several thousand acres of oak forests in this forest preserve district serve as the major recreational areas for the people of Chicago and vicinity. Destruction of these oak forests by oak wilt can be a major disaster for the people in this area.

Oak wilt was first observed in 1946 in Sinissippi Forest, a privately owned hardwood forest of 1700 acres near Oregon, Illinois. At that time, a few scattered dead and dying trees were found in three separate locations. This seemed to indicate that the disease probably had been present for only one or two years. In subsequent years, the number of trees killed by the disease increased greatly. An effort is being made to salvage the oaks killed by wilt in this forest. Mr. Howard W. Fox, Forester-in-Charge, estimated in January, 1950, that 50,000 board feet of lumber have been obtained already and that another 50,000 board feet remain for salvage in wilt-killed trees. The number of oaks killed in this forest during the six or seven years that the disease has been present, if standing together, would represent an area of approximately 50 acres, according to Mr. Fox.

ILLINOIS STATE NATURAL HISTORY SURVEY, SECTION OF APPLIED BOTANY AND PLANT PATHOLOGY, URBANA

OAK WILT IN MINNESOTA

David W. French and Clyde M. Christensen

In general the disease is present where its principal hosts in Minnesota, Quercus ellipsoidalis and Q. borealis, grow in large numbers. It is most severe where relatively large areas are occupied by nearly pure stands of these trees or where they are the dominant members of the stand. Both of these trees extend some distance beyond the areas where wilt occurs, but largely as scattered individuals or isolated groups not solid stands. Large numbers of both of these species have been killed in recent years near the Twin Cities. In some areas one can see dozens of infection spots per square mile, most of them still relatively small, suggesting that some factor has favored either dissemination of or infection by the fungus in recent years.

A considerable number of Quercus macrocarpa have been killed by wilt in the vicinity of St. Paul and on the University campus. Their death is somewhat slower than that of the red oaks mentioned above, but they do not merely stag head, nor have we known an infected one to recover. Quercus alba appears to be highly resistant. Infections are rare in this species and usually only occasional branches will be killed.

UNIVERSITY OF MINNESOTA, UNIVERSITY FARM, ST. PAUL

NEW SHADE TREE DISEASES IN COLORADO[1]

W. D. Thomas, Jr.

During the summer of 1949 specimens of two shade-tree diseases on hosts not previously reported were sent to Colorado A and M College by E. J. Sinnamon, City Forester of Denver. One specimen was of green ash showing excellent symptoms of Veritcillium wilt. Isolations from the specimen yielded Verticillium albo-atrum Reinke & Berth. Although this disease is common in the elms and maples of this area, as far as can be ascertained this is the first report of the isolation of Verticillium from ash.

The second specimen was a leaf spot on staghorn sumach (Rhus typhina L.). The leaves had numerous yellow to brown lesions, the latter with gray centers. The lesions were irregular in shape. Old lesions had a tendency to split across the center. Badly infected leaves became yellow and fell prematurely. The disease was limited to a few trees in widely separated areas in Denver. It has not been observed elsewhere. Although it did not appear to be serious, it did cause severe defoliation of several trees.

Isolations from the lesions, grown on potato dextrose agar, yielded a velvety mouse-gray to olivaceous black fungus which has been identified tentatively as Alternaria tenuis auct. Neer.[2] Saplings of R. typhina, inoculated with a spore suspension of the organism in a moist chamber, produced symptoms of the leaf spot within one week.

In Fort Collins an unidentified species of Fusarium was obtained from two adjacent staghorn sumachs. There was no marked discoloration of the vascular system, but the trees wilted in the afternoon heat, and recovered each night. Within two weeks after the first wilting occurred the lower leaves became yellow, and then dropped off a week later. There was no indication of drouth, for the trees had been watered well twice each week. Although no controlled experiment was conducted in an effort to control the disease, Dithane Z-78 was applied at the base of one of the trees at the rate of 5 lbs. per 100 sq. ft. The dust was worked into the soil and the treated area soaked thoroughly. Despite excessive heat during this period, all symptoms of the wilt had disappeared within three weeks following treatment. The untreated tree wilted further, finally dying before the summer's end. This reaction raises an interesting problem of chemotherapy which is to be studied in detail.

COLORADO AGRICULTURAL EXPERIMENT STATION, FORT COLLINS, COLORADO

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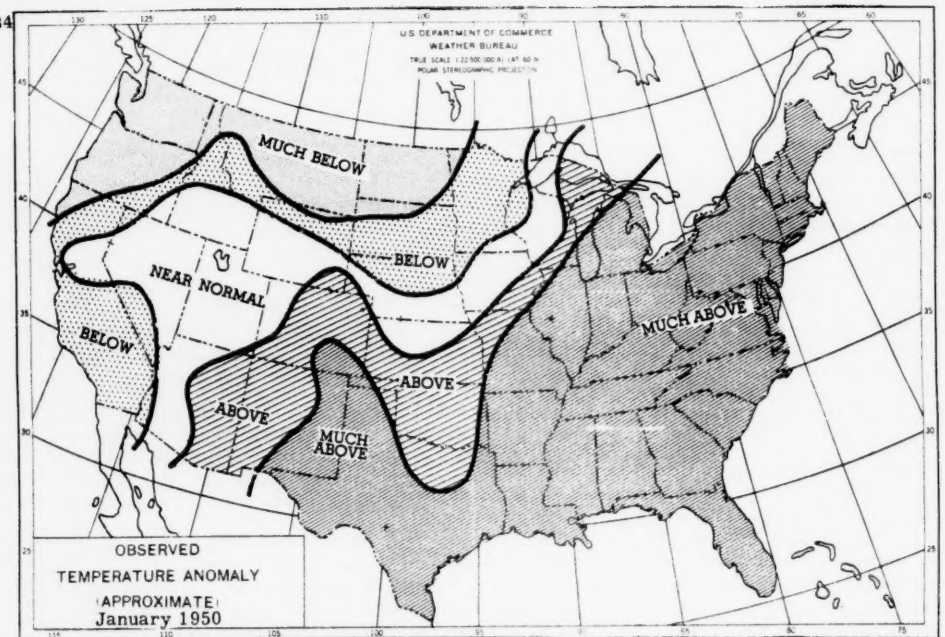
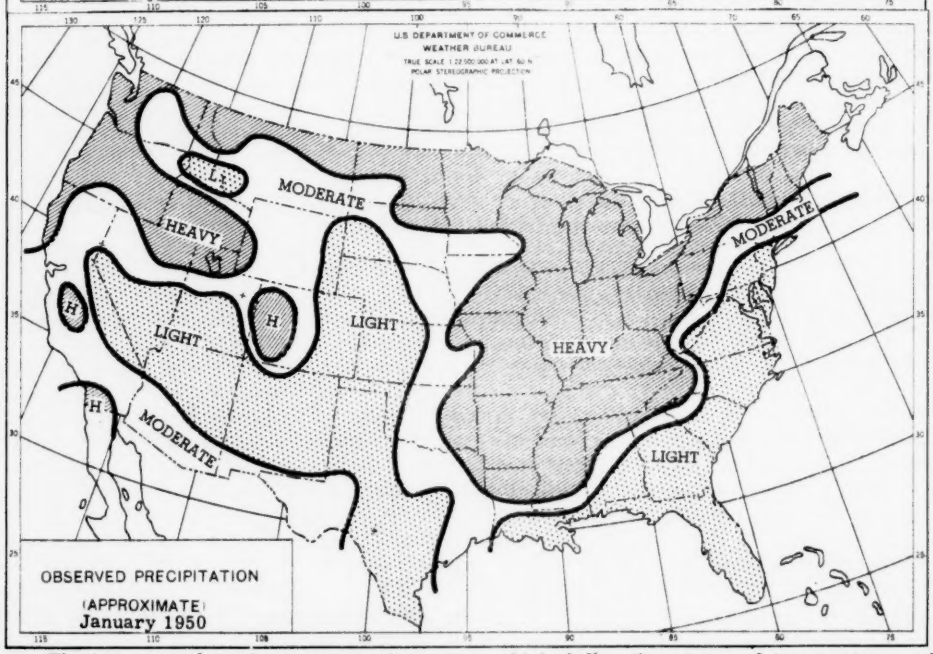
[1] Colorado Agricultural Experiment Station Scientific Journal Series No. 321.

[2] Neergard, Paul. Danish species of Alternaria and Stemphylium. Oxford University Press, London. 560 pp. 1945.





The terms used in the accompanying maps, which define the ranges of temperature and precipitation, are numerical class limits. These are based on a statistical analysis of past records through which is determined the normal frequency of occurrence of temperatures and precipitation at various times of the year for different locations. For temperature the classes above, below, and near normal are so defined that they each normally occur one-fourth of the time; much above and much below normal, one-eighth of the time. Precipitation is depicted in terms of light, moderate, and heavy, each class normally occurring one-third of the time and thereby having equal probability of occurrence. These maps graphically represent only the general trends and give the country's weather picture at a glance. For quantitative studies, where monthly mean temperatures and actual precipitation records are needed for a given time and place, other publications of the Weather Bureau should be consulted. P. R. M.